

Introduction

MB1801B-01 is wireless and ultra-low-power board embedding a powerful and ultra-low-power radio compliant with the Bluetooth® Low Energy SIG specification v5.3, IEEE 802.15.4-2015 PHY and MAC, supporting Thread, Chip and Zigbee®.

Figure 1 NUCLEO-WBA55CG global view



1. Features

- Ultra-low-power wireless [STM32WBA55CG](#) microcontroller based on the Arm® Cortex®-M33 core, featuring 1 Mbyte of flash memory and 128 Kbytes of SRAM in a UFQFPN48 package
- MCU RF board (MB1803):
 - 2.4 GHz RF transceiver supporting Bluetooth® specification v5.3
 - IEEE 802.15.4-2015 PHY and MAC, supporting Thread, Chip and Zigbee®
 - Arm® Cortex® M33 CPU with Arm® TrustZone®, MPU, DSP, and FPU – Integrated PCB antenna
- Comprehensive free software libraries and examples available with the [STM32CubeWBA](#) MCU Package
- Support of a wide choice of Integrated Development Environments (IDEs) including IAR Embedded Workbench®, MDK-ARM, and STM32CubeIDE

Note: Arm and TrustZone are registered trademarks of Arm Limited (or its subsidiaries) in the US and/or elsewhere.



2. Ordering information

To order the NUCLEO-WBA55CG board, refer to [Table 1](#). Additional information is available from the datasheet and reference manual of the target microcontroller.

Table 1. List of available products

Order code	Board reference	Target STM32
MB1803B-01	MB1803	STM32WBA55CG

2.1 Codification

The meaning of the codification is explained in [Table 2](#).

Table 2. Codification explanation

NUCLEO-WBXXYYRZ	Description	Example: NUCLEO-WBA55CG
XX	MCU series in STM32 32-bit Arm Cortex MCUs	STM32WBA series
YY	MCU product line in the series	STM32WBA55 product line
R	STM32 package pin count: • C for 48 pins	48 pins
Z	STM32 flash memory size: • G for 1 Mbyte	1 Mbyte

3. Development environment

3.1 Development toolchains

- IAR Systems® - IAR Embedded Workbench®⁽¹⁾
- Keil® - MDK-ARM⁽¹⁾
- STMicroelectronics - STM32CubeIDE

1. On Windows® only.

3.2 Demonstration software

The demonstration software, included in the STM32Cube MCU Package corresponding to the on-board microcontroller, is preloaded in the STM32 flash memory for easy demonstration of the device peripherals in standalone mode. The latest versions of the demonstration source code and associated documentation can be downloaded from www.st.com.

4. Conventions

Table 3 provides the conventions used for the ON and OFF settings in the present document.

Table 3. ON/OFF convention

Convention	Definition
Jumper JPx ON	Jumper fitted
Jumper JPx OFF	Jumper not fitted
Jumper JPx [1-2]	Jumper fitted between Pin 1 and Pin 2
Solder bridge SBx ON	SBx connections closed by 0 Ω resistor
Solder bridge SBx OFF	SBx connections left open
Resistor Rx ON	Resistor soldered
Resistor Rx OFF	Resistor not soldered
Capacitor Cx ON	Capacitor soldered
Capacitor Cx OFF	Capacitor not soldered

5. Safety recommendations

5.1 Targeted audience

This product targets users with at least basic electronics or embedded software development knowledge like engineer, technician, or student.

This board is not a toy and is not suited for use by children.

5.2 Handling the board

This product contains a bare printed circuit board and as with all products of this type, the user must be careful about the following points:

- 5.2.1 The connection pins on the board might be sharp. Be careful when handling the board to avoid hurting yourself
- 5.2.2 This board contains static-sensitive devices. To avoid damaging it, please handle the board in an ESD-proof environment.
- 5.2.3 While powered, do not touch the electric connections on the board with your fingers or anything conductive. The board operates at voltage levels that are not dangerous, but components could be damaged when shorted.
- 5.2.4 Do not put any liquid on the board and avoid operating the board close to water or at a high humidity level.
- 5.2.5 Do not operate the board if dirty or dusty.

6. Hardware layout and configuration

NUCLEO-WBA55CG is designed around the STM32WBA55CG. The design includes a mezzanine board and an MCU RF board. The hardware block diagram in Figure 2 illustrates the connection between STM32WBA55CG and peripherals (ARDUINO® Uno V3 connectors, ST morpho connector, and embedded ST-LINK).

Figure 3 helps users locate these features on the MB1803B-01 board. The mechanical dimensions of the NUCLEO-WBA55CG product are shown in Figure 4.

Figure 2 Hardware block diagram

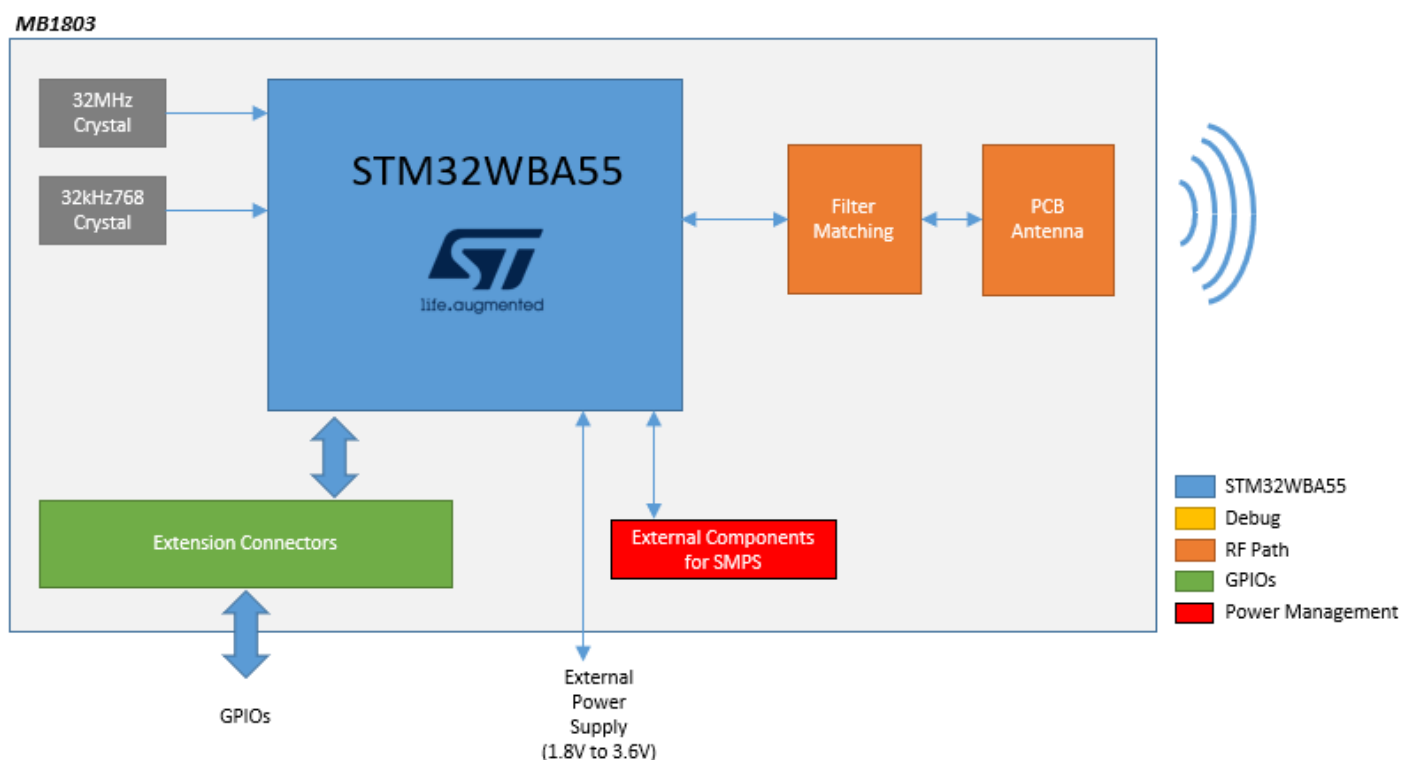


Figure 3 NUCLEO-WBA55CG PCB details of the MCU RF board (MB1803)

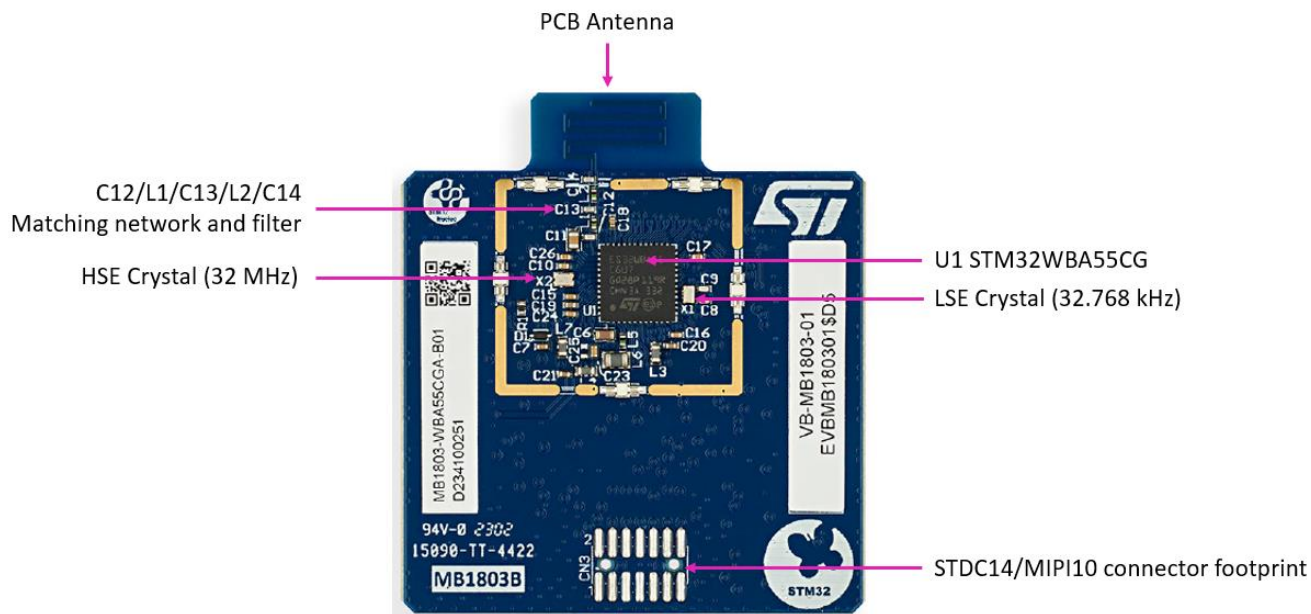
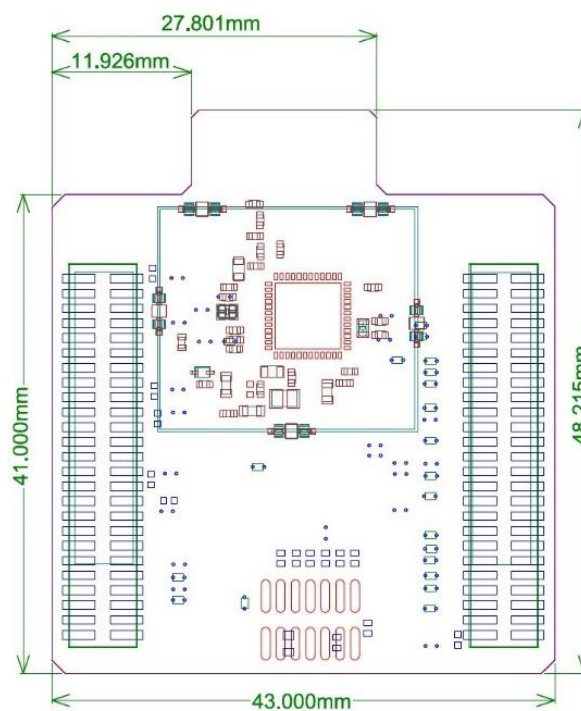


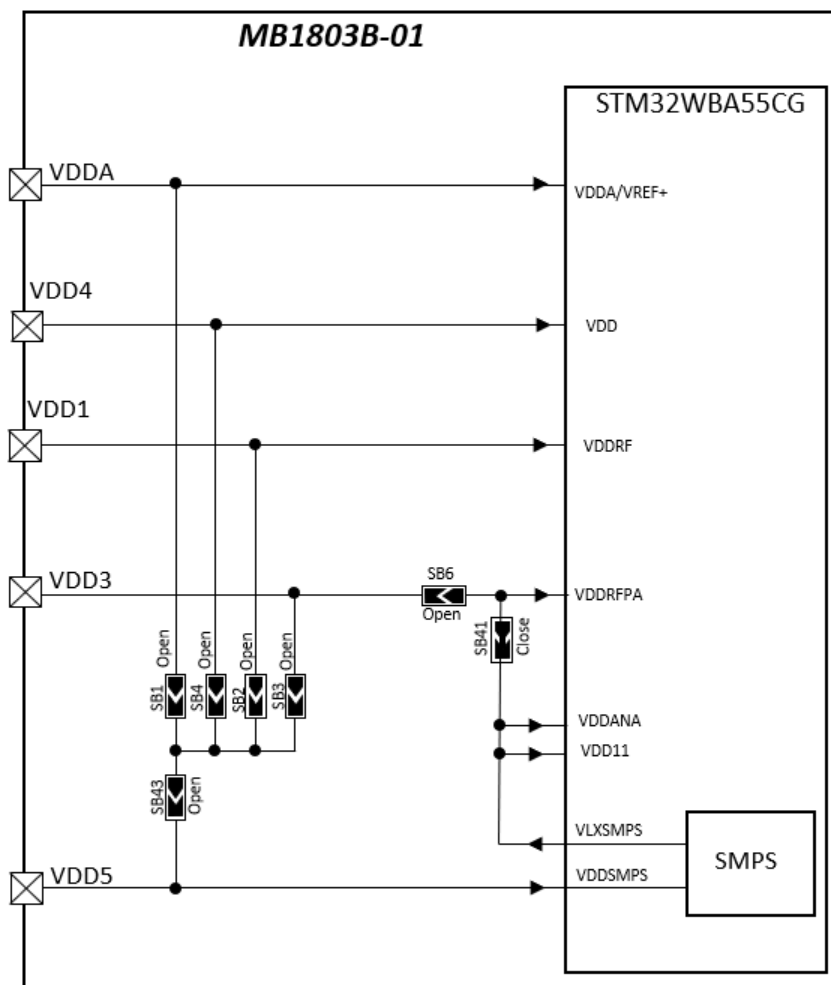
Figure 4 NUCLEO-WBA55CG (MB1803B) mechanical dimensions (in millimeters)



6.1 Power supply

The STM32WBA55CG can be supplied by an external source (between 1.8 and 3.3 V). this figure also shows the default state of the jumpers and the solder bridges.

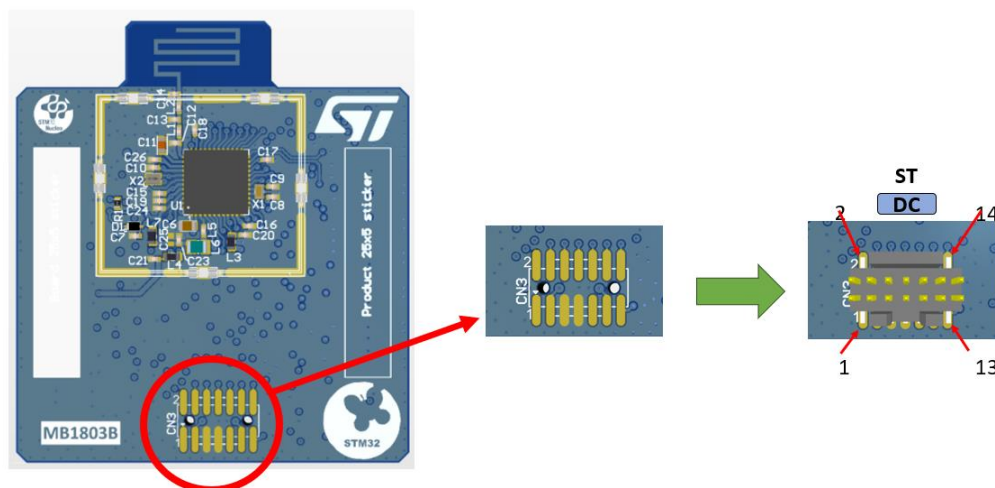
Figure 5 MB1803B-01 power tree



6.2 Debug

By default, the debug connector is not assembly on the MB1803B-01. If necessary, the connector should be soldered. By this way, that allows to select the type of connector STDC14 or MIPI10. The foot print is compatible with the both connectors.

Figure 6 CN3 assembly for debug connector

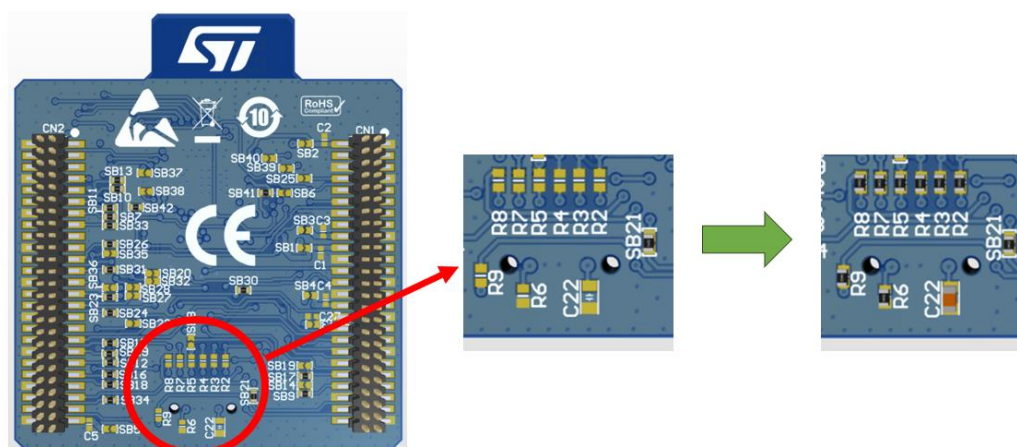


It is also necessary to add some components on the bottom side of the MB1803. On the table4, there are the value of the components and the Figure7 shows the location of these components.

Table 4. Components to add to support STLin-V3PWR config.

Designator	Value	Package	Example of Part Number
R2, R3, R4, R5, R6, R7, R8, R9	47R 1%	0402	YAGEO: RC0402FR-0747RL
C22	1uF/16V	0603	YAGEO: CC0603KRX5R7BB105

Figure 73 Components to add for STLink-V3PWR



6.3 Clock sources

7.2.1 HSE clock references

The accuracy of the high-speed clock (HSE) of the MCU RF board is committed to a 32 MHz crystal oscillator. The HSE oscillator is trimmed during board manufacturing.

7.2.2 LSE clock references

The accuracy of the low-speed clock (LSE) of the MCU RF board is committed to a 32.768 kHz crystal oscillator.

6.4 Reset sources

The reset signal of MB1803B-01 is active LOW. The internal PU forces the RST signal to a high level. The Hardware reset is accessible on pin 12 of CN1 connector.

6.5 RF I/O stage

Due to FCC/ISED constraints, the antenna cannot be removable. So, the board is proposed by default with a PCB antenna. This antenna is described on AN5129 available on the ST web site. Between the STM32WBA55 and the antenna, there is a passive network. This network has got two functions: makes a low pass filter and matches the impedance of the PCB antenna. These both functions are merged to reduce the number of components.

The output stage of the STM32WBA55 was optimized for this impedance of 50 ohms. That allow to facilitate the design of the external part.

Therefore, the low pass filter was study with an impedance of 50 ohms for SoC side and with the antenna impedance for the other side. To simplify, the bandwidth of the antenna was not taken in count. Parts of harmonics are filtered internally but for silicone size and cost, they are not completely suppressed. The low pass filter is to reduce the level of the harmonic to satisfy the certifications requirements (FCC, ISED, RED, MIC,...).

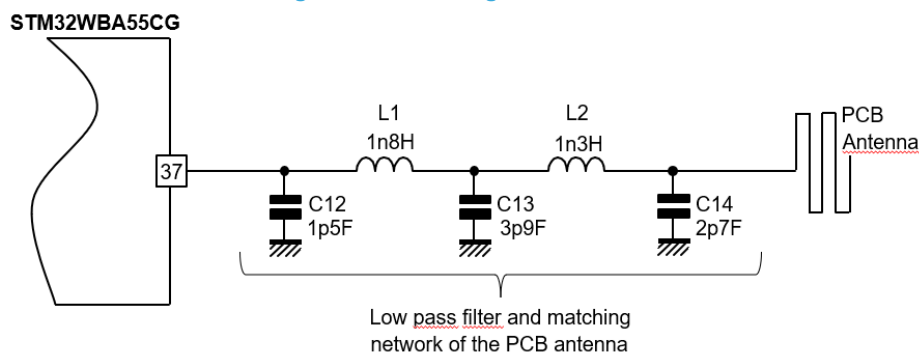
The table 8 shows the level of harmonic expected worst case at the output of the STM32WBA55 without filter. That allows to determinate the attenuation of the filter vs. frequency.

Table 8. harmonic level on the STM32WBA55 without external filter (TX mode@+10dBm)

Harmonic indice	Harmonic Level
H2	-28 dBm
H3	-45 dBm
H4	-54 dBm
H5	-78 dBm
H6	-66 dBm

This network is built with 5 components C12, L1, C13, L2, and C14. That guaranteed a comfortable margin in all cases. The study takes in count, the drift of the components (accuracy and temperature), the drift due to the PCB, and the variation of the STM32WBA55. Of course, depending on the components manufacturer and the specification of the PCB, these components values can change after mandatory optimisation.

Figure 4 RF I/O stage



6.6 MCU RF board interface and pinout

7.11.1 Description

The ST-MCU RF board connectors (CN1 and CN2) are accessible on the top side of the board. They are used to plug the MCU RF board into the mezzanine board.

7.11.2 Board pinout

Figure 5 Pinout of the MCU RF board connectors

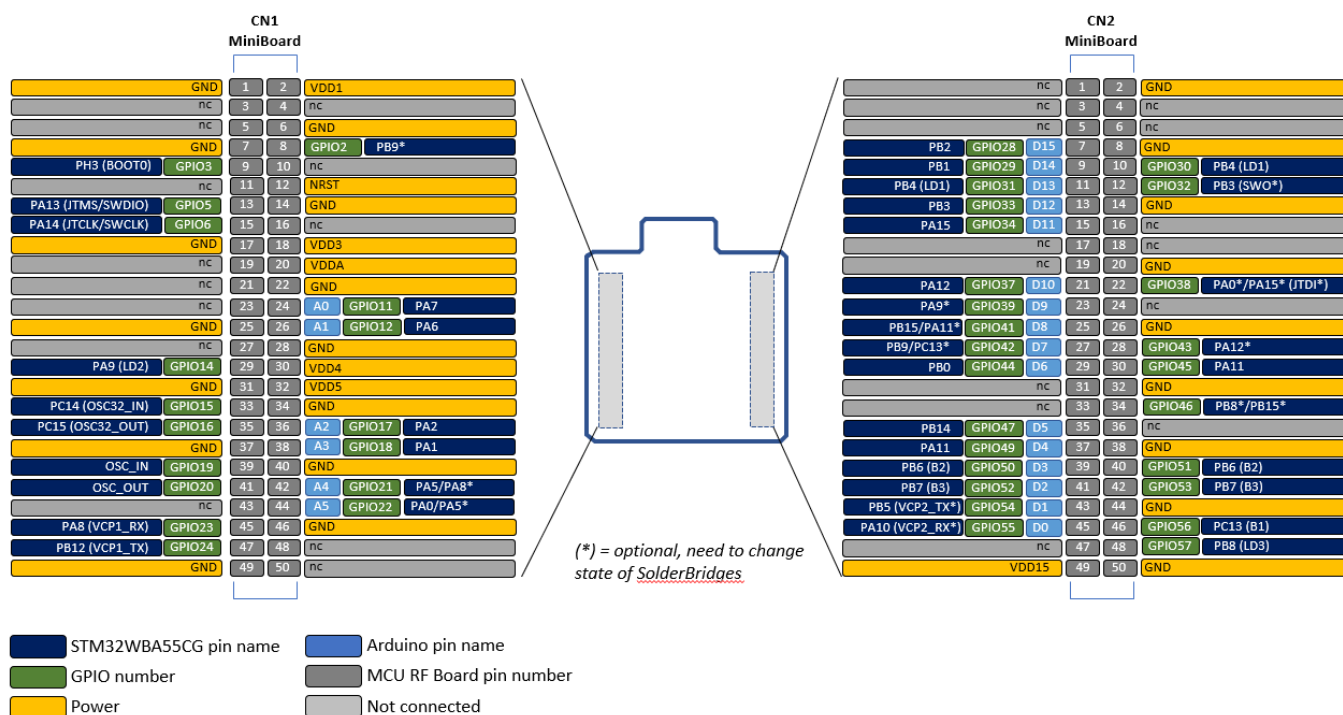


Table 11. Pinout of the MCU RF board connectors

CN1				CN2			
Pin number	STM32WBA55CG pin name	Pin number	STM32WBA55CG pin name	Pin number	STM32WBA55CG pin name	Pin number	STM32WBA55CG pin name
1	GND	2	VDD1	1	NC	2	GND
3	NC	4	NC	3	NC	4	NC
5	NC	6	GND	5	NC	6	NC
7	GND	8	PB9 ⁽¹⁾	7	PB2	8	GND
9	BOOT0	10	NC	9	PB1	10	PB4
11	NC	12	NRST	11	PB4	12	PB3/SWO ⁽¹⁾
13	PA13	14	GND	13	PB3	14	GND
15	PA14	16	NC	15	PA15	16	NC
17	GND	18	VDD3	17	NC	18	NC
19	NC	20	VDDA	19	NC	20	GND
21	NC	22	GND	21	PA12	22	PA0 ⁽¹⁾ /PA15 ⁽¹⁾ /JTDI ⁽¹⁾
23	NC	24	PA7	23	PA9 ⁽¹⁾	24	NC
25	GND	26	PA6	25	PB15/PA11 ⁽¹⁾	26	GND
27	NC	28	GND	27	PB9/PC13 ⁽¹⁾	28	PA12 ⁽¹⁾
29	PA9	30	VDD4	29	PB0	30	PA11
31	GND	32	VDD5	31	NC	32	GND
33	PC14	34	GND	33	NC	34	PB8 ⁽¹⁾ /PB15 ⁽¹⁾
35	PC15	36	PA2	35	PB14	36	NC
37	GND	38	PA1	37	PA11	38	GND
39	OSC_IN	40	GND	39	PB6	40	PB6
41	OSC_OUT	42	PA5/PA8 ⁽¹⁾	41	PB7	42	PB7
43	NC	44	PA0/PA5 ⁽¹⁾	43	PB5	44	GND
45	PA8	46	GND	45	PA10	46	PC13
47	PB12	48	NC	47	NC	48	PB8
49	GND	50	NC	49	VDD15	50	GND

1. Optional, need to change the state of solder bridges.

6.7 MIPI10/STDC14 connector pinout

7.12.1 Description

On the MCU RF Board, there is a footprint for direct debug. This footprint is compatible with MIPI10 and STDC14 connectors. STDC14 is an extension of the MIPI10 connector.

By default, on this footprint (CN3), the connector is not assembly. If some features not available on the STinkV3EC embedded on MB1801, it's possible to solder a MIPI10 or STDC14 connector. That allows to use an external debugger. Nevertheless, it will be necessary to disconnect the SWD (open SB15 and SB17 on the MB1801).

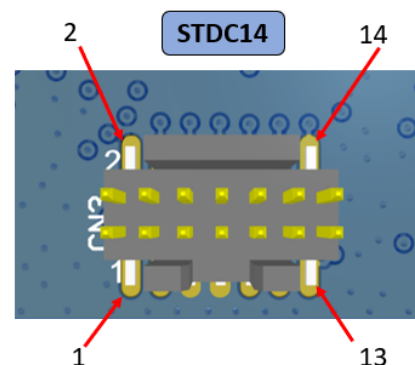
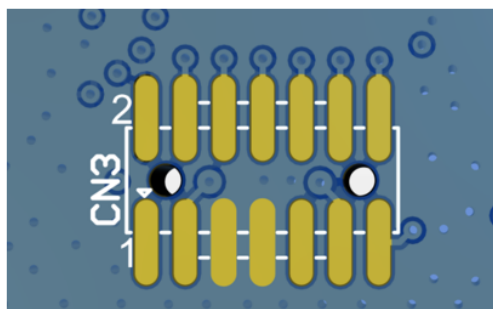
Example of connector compatible with this footprint :

- MIPI10 : FTSH-105-01-L-DV-K (SAMTEC)
- STDC14 : FTSH-107-01-L-DV-K (SAMTEC)

7.12.2 MIPI10/STDC14 pinout

Figure 6 Pinout of the MIPI10/STDC14 connector (CN3 of the MCU RF board)

STDC14	2	4	6	8	10	12	14
	Reserved	T_JTMS T_SWDIO	T_JCLK T_SWCLK	T_JTDO T_SWO	T_JTDI	T_NRST	T_VCP_TX
MIPI10		2	4	6	8	10	
		T_JTMS T_SWDIO	T_JCLK T_SWCLK	T_JTDO T_SWO	T_JTDI	T_NRST	



MIPI10		1	3	5	7	9	
		T_VCC	GND	GND	T_JCLK	GND Detect	
STDC14	1	3	5	7	9	11	13
	Reserved	T_VCC	GND	GND	T_JCLK	GND Detect	T_VCP_RX

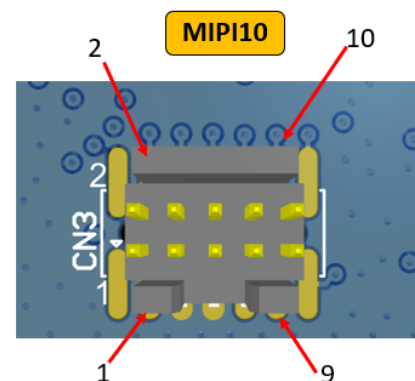


Table 12. Pinout of the MIPI10/STDC14 connector (CN3 of the MCU RF board)

STDC14 pin #	MIPI10 pin #	Pin description	Type
1	-	Reserved ⁽¹⁾	-
2	-	Reserved ⁽¹⁾	-
3	1	T_VCC ⁽²⁾	I
4	2	T_JTMS/T_SWDIO	I/O
5	3	GND	S
6	4	T_JCLK/T_SWCLK	O
7	5	GND	S
8	6	T_JTDO/T_SWO ⁽³⁾	I
9	7	T_JCLK	O
10	8	T_JTDI/NC ⁽⁴⁾	O
11	9	GNDDetect	O
12	10	T_NRST	O
13	-	T_VCP_RX	O
14	-	T_VCP_TX	I

7. MB1801B-01 product information

7.1 Product marking

The stickers located on the top or bottom side of all PCBs provide product information:

- First sticker: product order code and product identification, generally placed on the main board featuring the target device. Example:

Product order code
Product identification

- Second sticker: board reference with revision and serial number, available on each PCB. Example:

MBxxxx-Variant-yyz syywwxxxxx	
----------------------------------	---

On the first sticker, the first line provides the product order code, and the second line the product identification.

On the second sticker, the first line has the following format: “MBxxxx-Variant-yyz”, where “MBxxxx” is the board reference, “Variant” (optional) identifies the mounting variant when several exist, “y” is the PCB revision, and “zz” is the assembly revision, for example B01. The second line shows the board serial number used for traceability.

Parts marked as “ES” or “E” are not yet qualified and therefore not approved for use in production. ST is not responsible for any consequences resulting from such use. In no event will ST be liable for the customer using any of these engineering samples in production. ST’s Quality department must be contacted prior to any decision to use these engineering samples to run a qualification activity.

“ES” or “E” marking examples of location:

- On the targeted STM32 that is soldered on the board (for an illustration of STM32 marking, refer to the STM32 datasheet *Package information* paragraph at the www.st.com website).
- Next to the evaluation tool ordering part number that is stuck, or silk-screen printed on the board.

Some boards feature a specific STM32 device version, which allows the operation of any bundled commercial stack/library available. This STM32 device shows a “U” marking option at the end of the standard part number and is not available for sales.

To use the same commercial stack in their applications, the developers might need to purchase a part number specific to this stack/library. The price of those part numbers includes the stack/library royalties.

8. MB1801B-01 product history

Table 13. Product history

Order code	Product identification	Product details	Product change description	Product limitations
MB1803B-01	MB1801B-01	MCU: STM32WBA55CGU6 silicon revision "Z"	Initial revision	No limitation
		MCU errata sheet: <i>STM32WBA55xx device errata</i> (ES0592)		
		Boards: MB1803-WBA55CG-B01		

8.1 Boards revision history

Table 14. Board revision history

Board reference	Board variant and revision	Board change description	Board limitations
MB1803 (MCU RF board)	MB1803-WBA55CG-B01	Initial revision	No limitation

9. Federal Communications Commission (FCC) and ISED Canada

9.1 FCC Compliance Statement

Changes or modifications not expressly approved by STMicroelectronics could void the user's authority to operate the equipment.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

FCC ID: YCP-MB180300

Model name: MB1803B-01

Applicable FCC rules: This module has been approved under FCC part 15C 15.247 in the frequency range 2400-2483.5MHz. This modular transmitter is only FCC authorized for this specific rule part.

Specific operational use conditions :

- The module is limited to OEM installation ONLY.

Limited module procedures are not applicable to this application.

Trace antenna design is not applicable to this application.

Radio Frequency (RF) Exposure Compliance of Radio communication: To satisfy FCC RF Exposure requirements, a separation distance of 20cm or more should be maintained between the antenna of this device and persons during operation. To ensure compliance, operation at a closer distance than this is not recommended. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

List of antenna type approved: Not applicable (Antenna is printed on the PCB module)

End Product Labeling: if the host is marketed so that end users do not have straight forward commonly used methods for access to remove the module so that the FCC ID of the module is visible; then an additional permanent label referring to the enclosed module shall be added:

"Contains Transmitter Module FCC ID: YCP-MB180300" or "Contains FCC ID: YCP-MB180300" must be used.

Additional testing requirements:

- If testing of the host product with this transmitter installed and operating is necessary (to verify that the host product meets all the applicable FCC rules), a test mode for this specific module is available upon request to STMicroelectronics.

- The host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. (For example, Part 15 Subpart B)

9.2 ISED Compliance Statement

IC: 8976A- MB180300
Product Marketing Name: MB1803B
HVIN: MB1803B-01

This device contains licence-exempt transmitter(s)/receivers(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:

1. This device may not cause interference.
2. This device must accept any interference, including interference that may cause undesired operation of the device.

Applicable ISED-CANADA rules: This module has been approved under RSS-247 in the frequency range 2400-2483.5MHz. This modular transmitter is only ISED authorized for this specific rule part.

Specific operational use conditions:

- The module is limited to OEM installation ONLY.
- If other parameters (power setting) other than the type documented in the filing, a class 2 permissive change must be filed with ISED-CANADA.

Limited module procedures are not applicable to this application.

Trace antenna design is not applicable to this application.

Radio Frequency (RF) Exposure Compliance of Radio communication: To satisfy ISED-Canada RF Exposure requirements, a separation distance of 20cm or more should be maintained between the antenna of this device and persons during operation. To ensure compliance, operation at a closer distance than this is not recommended. This transmitter must not be co- located or operating in conjunction with any other antenna or transmitter.

This radio transmitter IC: 8976A-MB180300 has been approved by Innovation, Science and Economic Development Canada to operate with the PCB antenna printed on the module.

List of antenna type approved: Not applicable

End Product Labeling: If the IC number is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. This exterior label can use wording such as the following: "Contains IC: 8976A-MB180300"

Additional testing requirements:

- If testing of the host product with this transmitter installed and operating is necessary (to verify that the host product meets all the applicable ISED-Canada rules), a test mode for this specific module is available upon request to STMicroelectronics.
- The host product manufacturer is responsible for compliance to any other ISED rules that apply to the host not covered by the modular transmitter grant of certification. (For example, ICES-003)

9.3 ISDE – Canada, Appareils radio exempts de licence

IC: 8976A-MB180300

Nom de marque du produit: MB1803B

NIVM: MB1803B-01

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :

- 1- L'appareil ne doit pas produire de brouillage.
- 2- L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Règles ISDE-CANADA applicables : Ce module a été approuvé suivant la norme RSS-247 dans la gamme de fréquences 2400-2483.5 MHz. Cet émetteur modulaire est uniquement autorisé par ISDE pour cette partie de règle spécifique.

Conditions opérationnelles spécifiques d'utilisation :

- Le module est limité à l'installation OEM UNIQUEMENT.
- Si d'autres paramètres (réglage de puissance) autres que ceux documentés dans le dossier, un changement permissif de classe 2 doit être déposé auprès d'ISDE-CANADA.

Les procédures de module limité ne sont pas applicables à cette application.

Conception de la piste d'antenne : Non applicable (Antenne PCB intégrée au module)

Conformité des communications radio en matière d'exposition aux radiofréquences (RF) : Pour satisfaire aux exigences d'ISDE-Canada en matière d'exposition aux radiofréquences, une distance de séparation de 20 cm ou plus doit être maintenue entre l'antenne de cet appareil et les personnes pendant le fonctionnement. Pour assurer la conformité, il est déconseillé d'utiliser cet équipement à une distance inférieure. Cet émetteur ne doit pas être co-situé ou fonctionner conjointement avec une autre antenne ou un autre émetteur.

Le présent émetteur radio IC: 8976A-MB180300 a été approuvé par Innovation, Sciences et Développement économique Canada pour fonctionner avec l'antenne imprimée sur le PCB du module.

Liste des types d'antennes approuvés : Non applicable

Étiquetage du produit final : si le numéro IC n'est pas visible lorsque le module est installé à l'intérieur d'un autre appareil, alors l'appareil dans lequel le module est installé doit également porter une étiquette faisant référence au module fourni. Cette étiquette extérieure peut utiliser des formulations telles que les suivantes : « Contient IC: 8976A-MB180300 »

Exigences de tests supplémentaires :

- Si un test du produit hôte avec cet émetteur installé et opérationnel est nécessaire (pour vérifier que le produit hôte répond à toutes les règles applicables d'ISDE-Canada), un mode de test pour ce module spécifique est disponible sur demande à STMicroelectronics.
- Le fabricant du produit hôte est responsable du respect de toutes les autres règles ISDE applicables à l'hôte non couvertes par l'octroi de certification de l'émetteur modulaire. (Par exemple, ICES-003)

10. RED Compliance Statement

Déclaration de conformité CE simplifiée

STMicroelectronics déclare que l'équipement radioélectrique du type " MB1803B-01" est conforme à la directive 2014/53/UE.

Simplified UE compliance statement

Hereby, STMicroelectronics declares that the radio equipment type " MB1803B-01" is in compliance with Directive 2014/53/EU.

11. UKCA Compliance Statement

SIMPLIFIED UK DECLARATION OF CONFORMITY

Hereby, the manufacturer STMicroelectronics, declares that the radio equipment type "MB1803B-01" is in compliance with The UK Radio Equipment Regulations 2017 (UK S.I. 2017 No. 1206). The full text of the UK declaration of conformity is available at the following internet address: www.st.com

12. Revision history

Table 15. Document revision history

Date	Revision	Changes
13-Dec-2023	1	Initial release.
22-Feb-2024	2	Updated FCC information
29-Feb-2024	3	Updated ISED information

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